

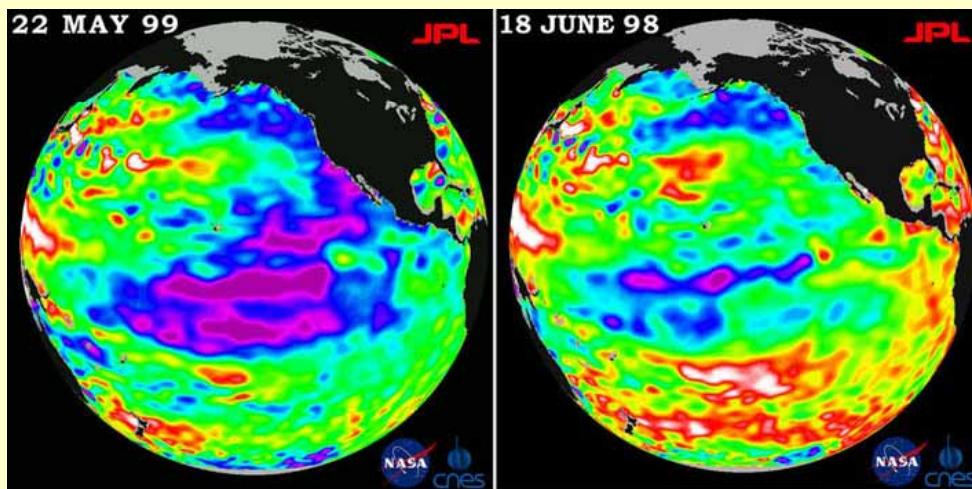
Climate Indices – Cliff Dahm

El Niño Southern Oscillation (ENSO)

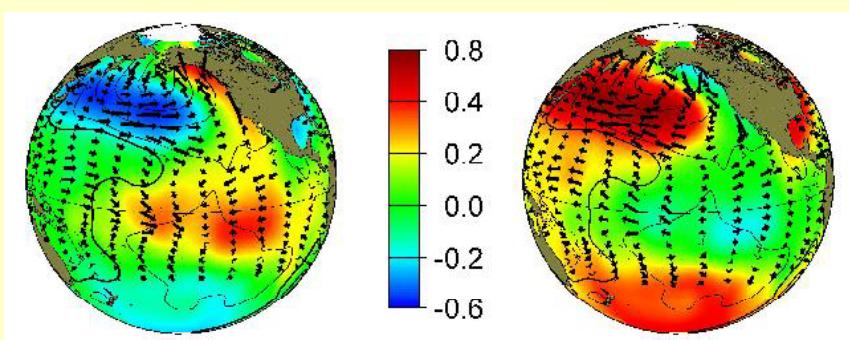
Pacific Decadal Oscillation (PDO)

North Pacific Gyre Oscillation (NPGO)

(The atmosphere brings us weather, the oceans bring us climate)



Strong and Weak La Niña (ENSO)



Mantua et al. (1997)
Pacific Decadal Oscillation (PDO)
Warm and Cold PDO Phases

El Niño Southern Oscillation (ENSO)



Dr. William H. Quinn – (1918-1994)

JOURNAL OF GEOPHYSICAL RESEARCH, VOL. 92, NO. C13, PAGES 14,449-14,461, DECEMBER 15, 1987

El Niño Occurrences Over the Past Four and a Half Centuries

WILLIAM H. QUINN AND VICTOR T. NEAL

College of Oceanography, Oregon State University, Corvallis

SANTIAGO E. ANTUNEZ DE MAYOLO

Banco Central de la Reserva del Perú, Lima, Peru

- Weather Analyst and Forecaster – US Army Air Corps in World War II
- Chief climatologist for Tokyo Weather Central after World War II
- Ph.D in 1968 at Age 50 (Incoming Solar Radiation over the Tropical Pacific)
- Earliest El Niño Prediction (1974)
- My Surrogate Major Professor (1978-1980)
- 450 Year History of El Niño Occurrences

Sevilleta New Mexico Long-Term Ecological Research (LTER) Proposal - 1988

LONG-TERM ECOLOGICAL RESEARCH ON CLIMATIC and ECOLOGICAL GRADIENTS: SEVILLE & NATIONAL WILDLIFE REFUGE

Principal Investigator: James R. Gosz

Co-Principal Investigators:

R. Anderson

J. Brown

C. Crawford

C. Dahm

D. Duszynski

J. Findley

H. Grover

G. Johnson

T. Kieft

D. Marshall

B. Milne

M. Molles

B. Musick

H. Snell

S. Wells

C. Wisdom

T. Yates

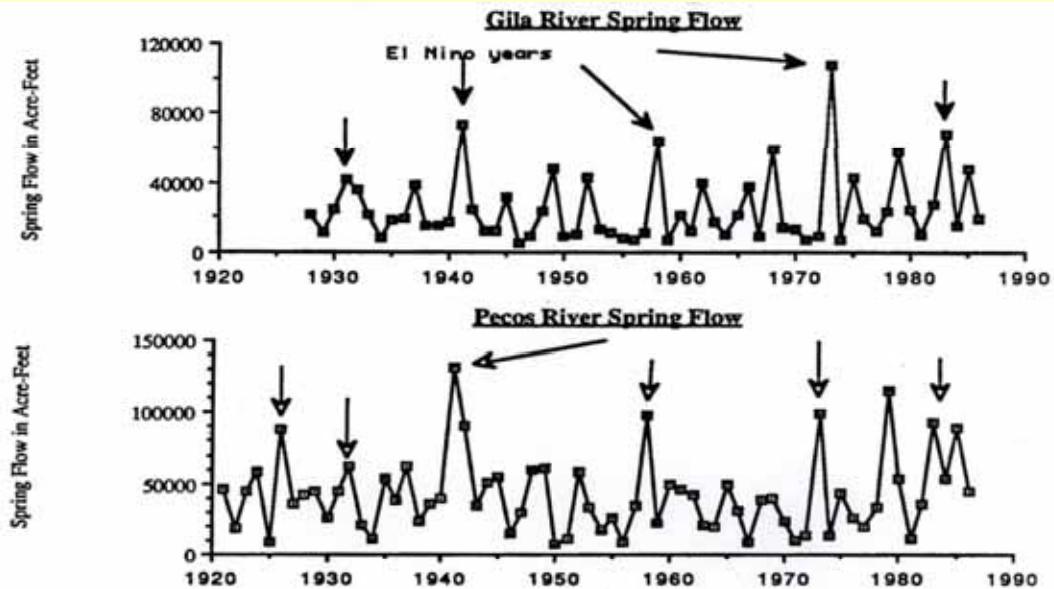
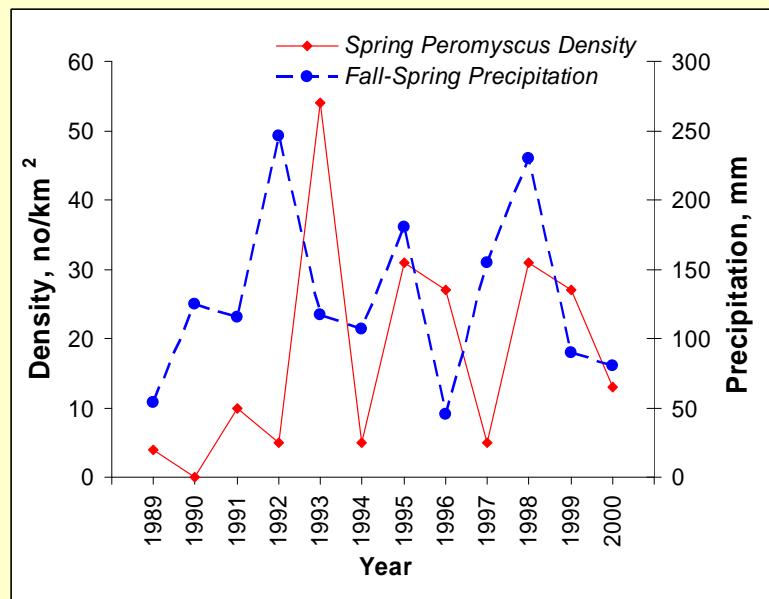


FIGURE 7: Spring discharge for the Gila and Pecos watersheds.

Table 3. Total precipitation (1850-1984) and winter-spring precipitation (1850-1954) at Socorro, NM during non-El Nino, El Nino, and anti-El Nino years as defined by Quinn et al. (1988).

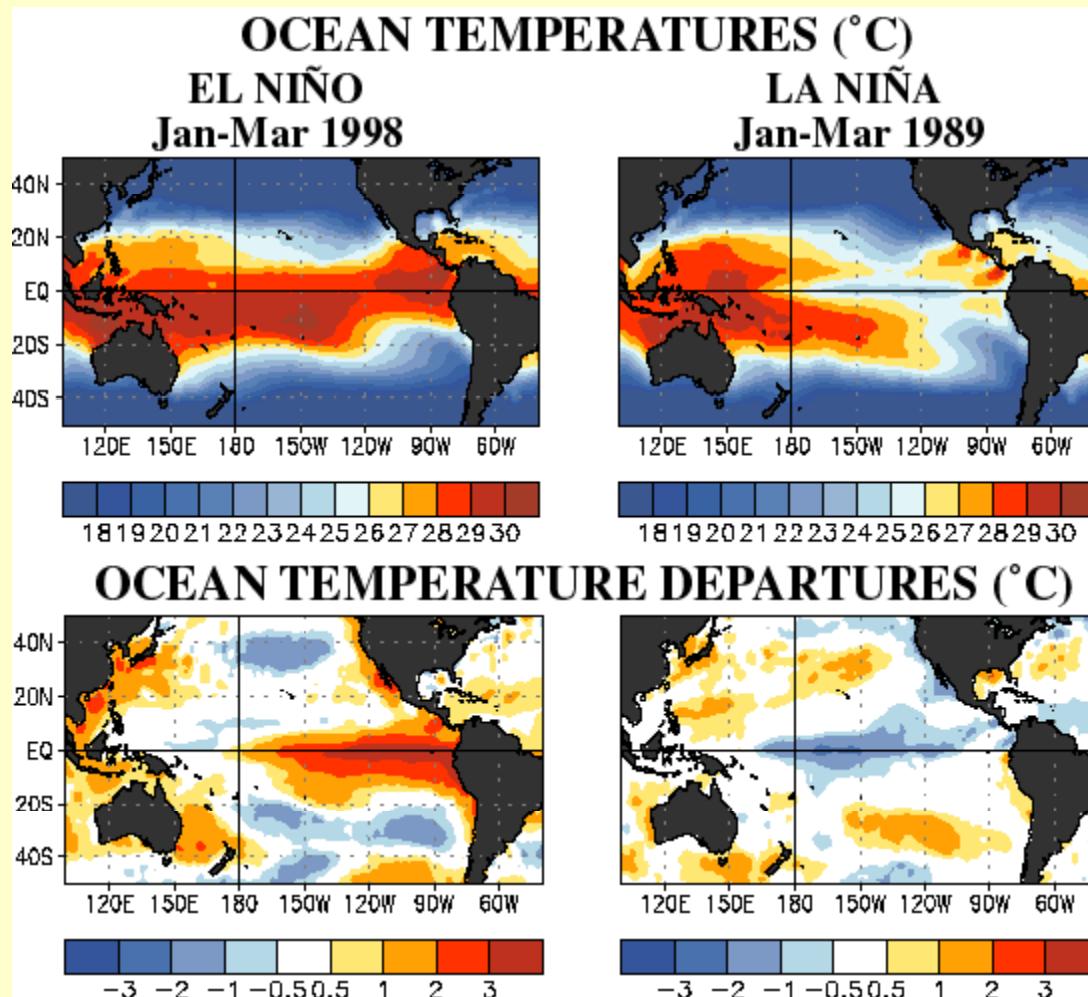
	Total Ppt (mm)	N	Winter-Spring Ppt (mm)	N
Years				
Non—El Nino	231.0	42	72.0	42
El Nino	291.7	26	101.7	26
Anti—El Nino	184.0	14	41.5	15
	p = 0.003		p = 0.001	

The ENSO Phenomenon, the Sevilleta LTER, and Emergent Disease



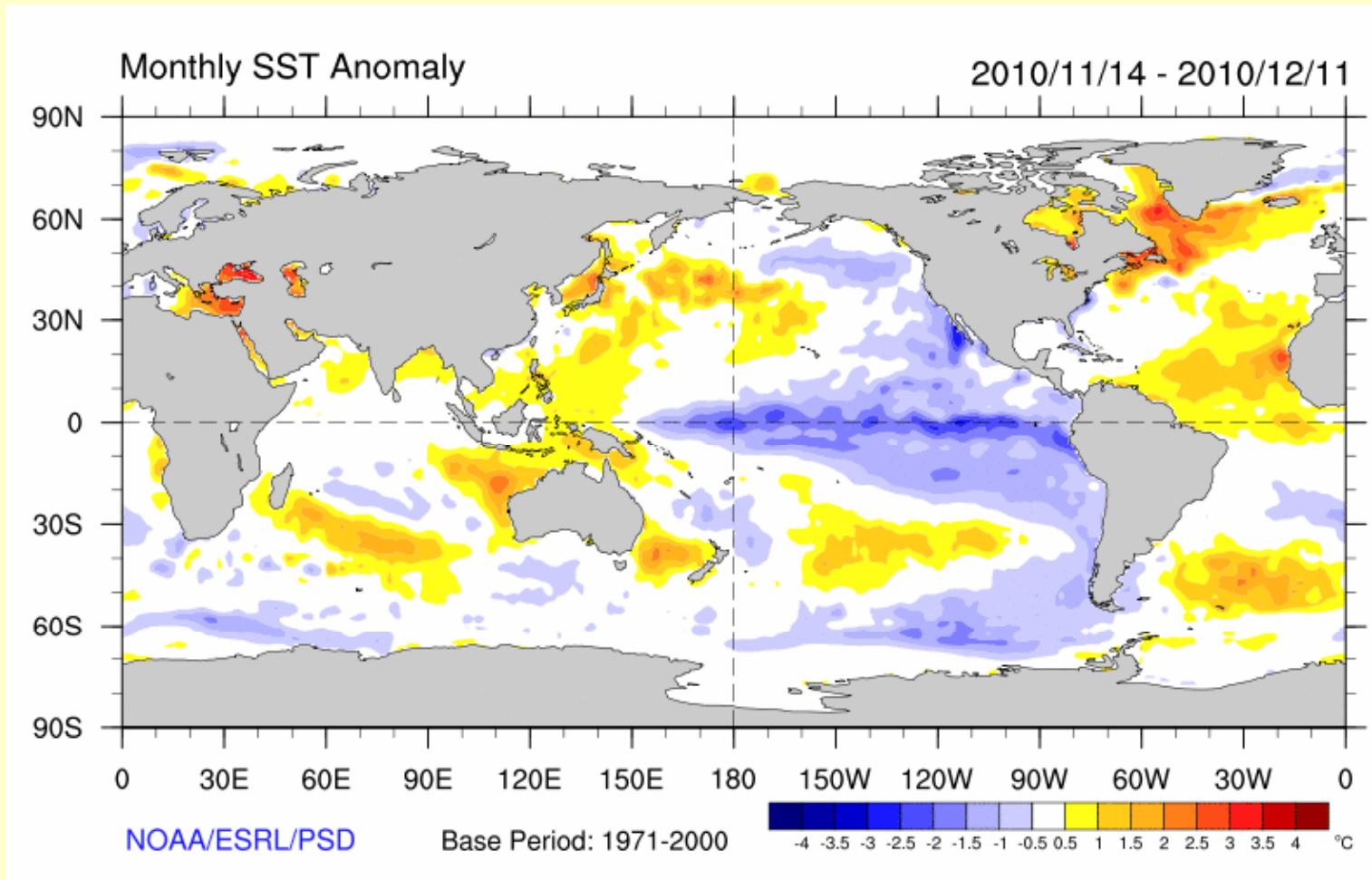
- “Evidence from two El Niño episodes in the American Southwest suggests that El Niño-driven precipitation, the initial catalyst of a trophic cascade that results in a delayed density-dependent rodent response, is sufficient to predict heightened risk for human contraction of hantavirus pulmonary syndrome.”
- Yates et al. 2002. The Ecology and Evolutionary History of an Emergent Disease: Hantavirus Pulmonary Syndrome. BioScience 52:989-998.

El Niño and La Niña

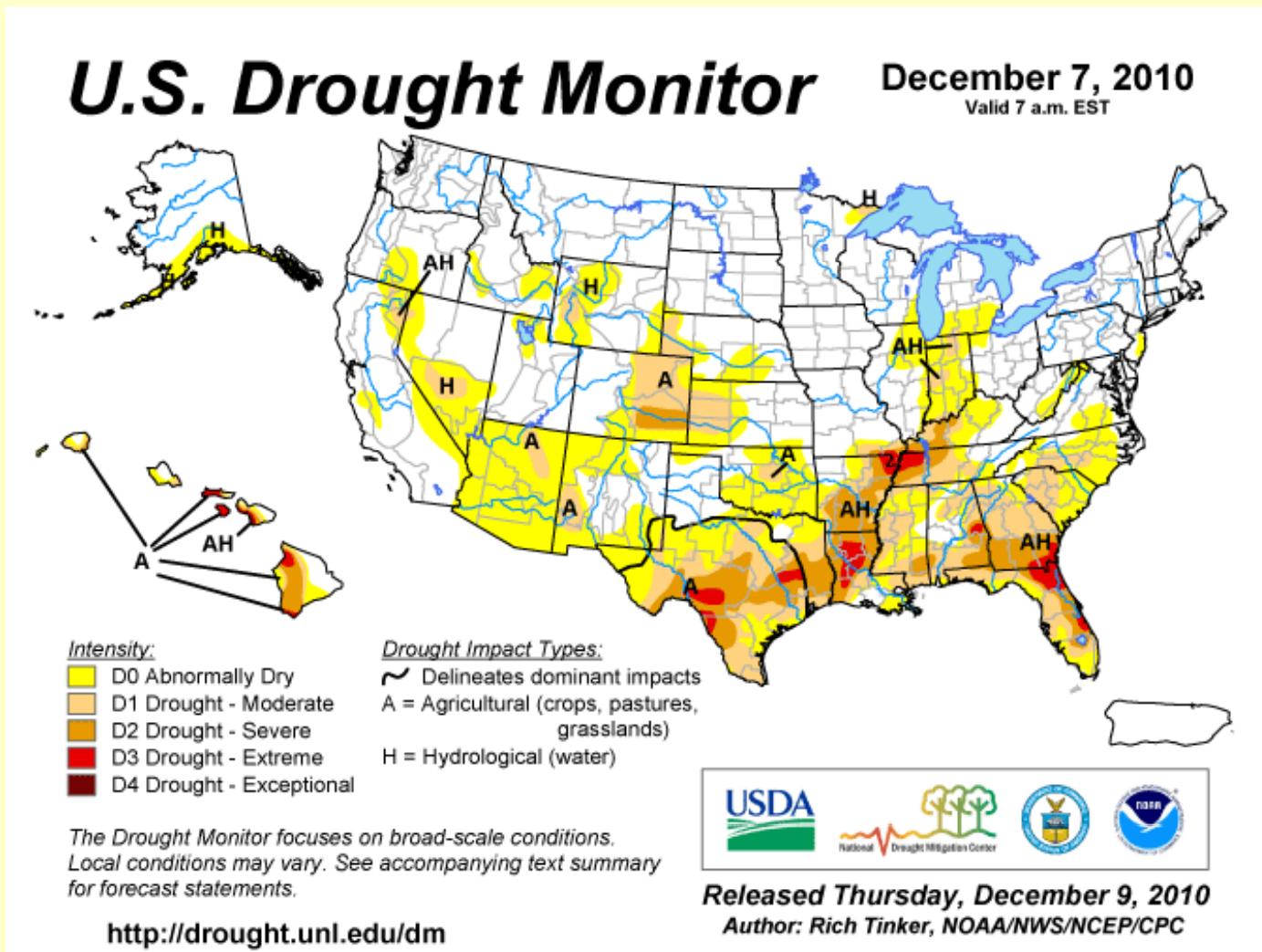


Other diagnostic tools are winds, cloudiness, vertical temperature gradients, ocean surface elevations, and ocean currents

Current Sea Surface Temperature Anomalies

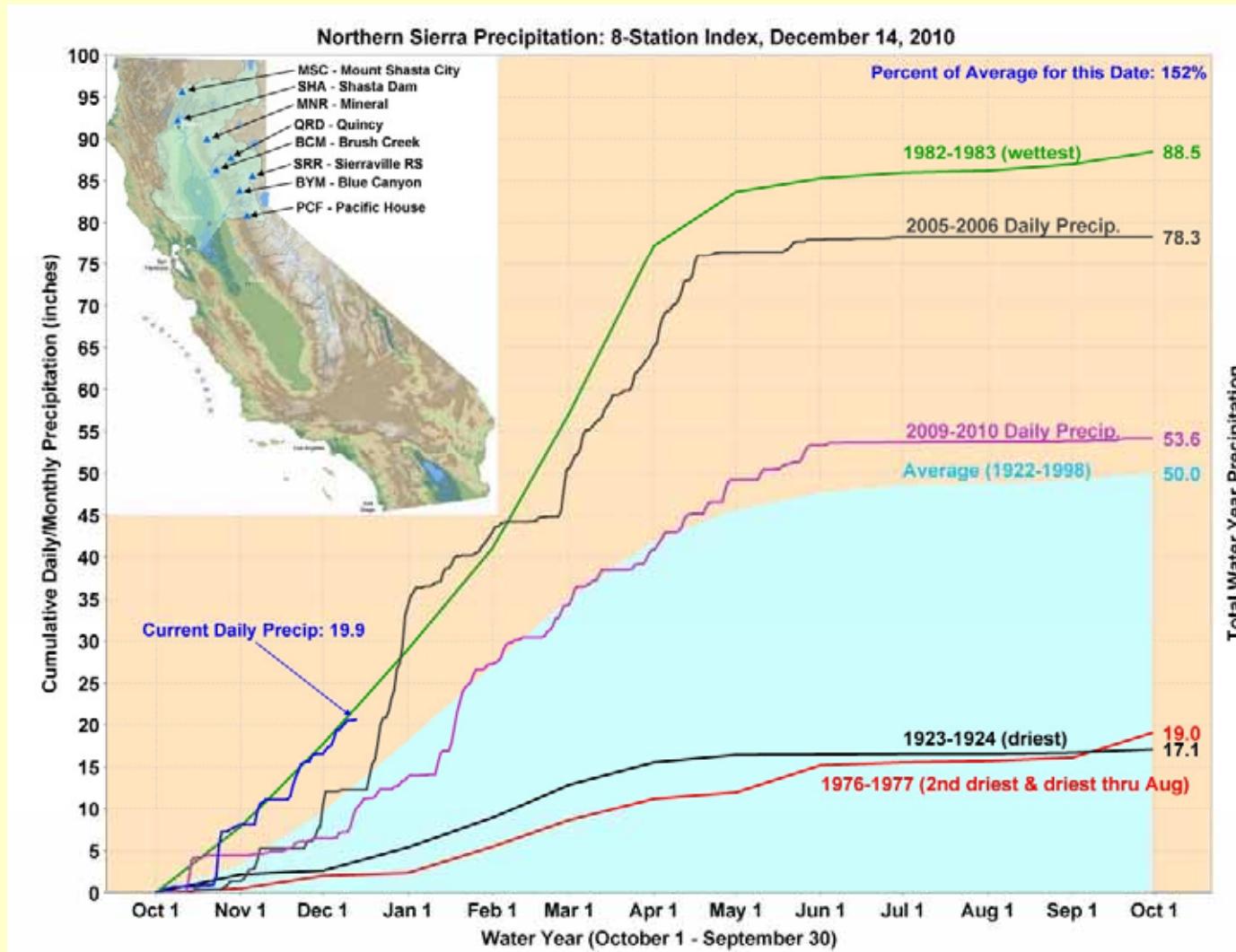


Current US Drought



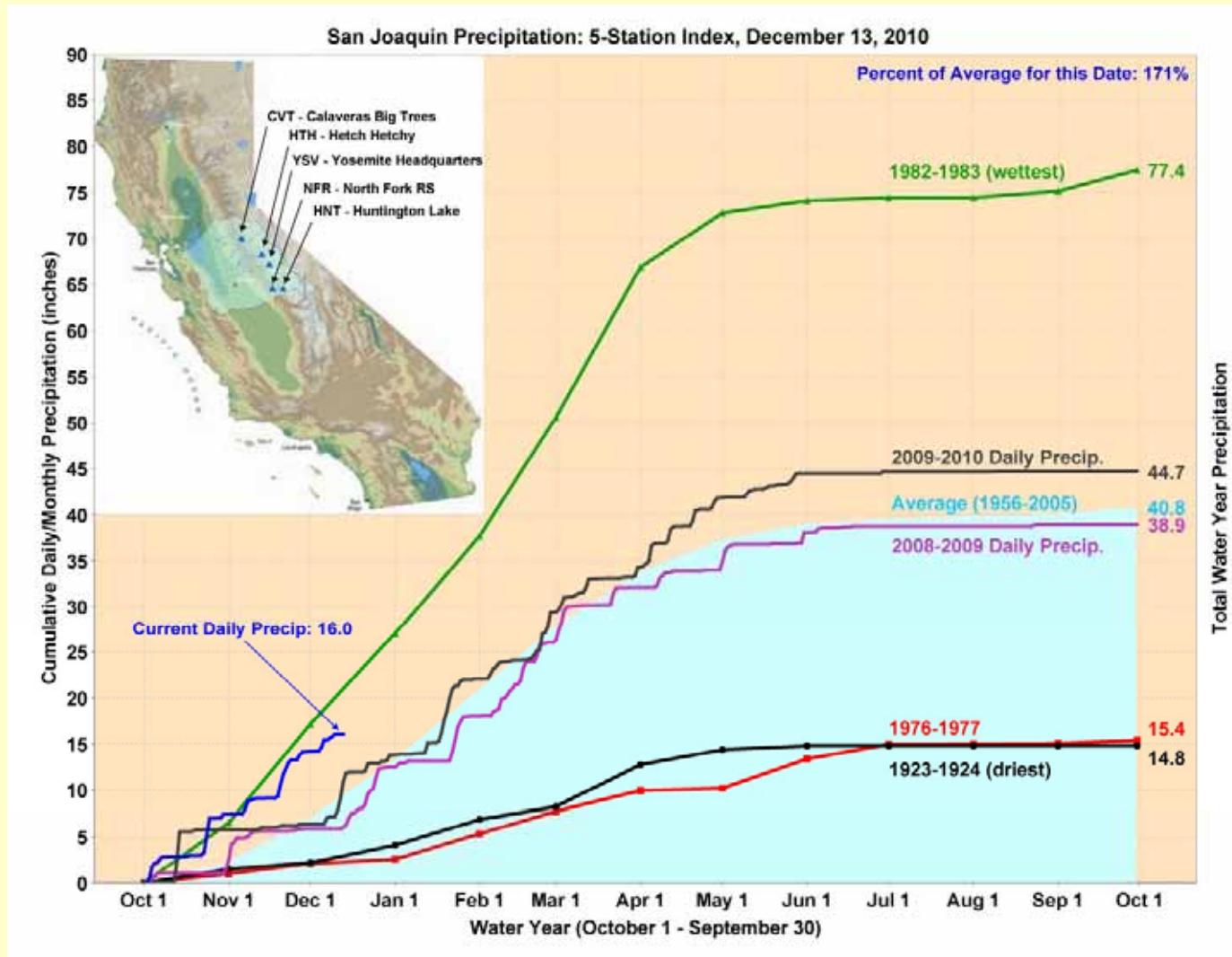
Current Water Year

Cumulative Precipitation – Northern Sierra



Current Water Year

Cumulative Precipitation - Central Sierra



PDO – 1925-2010

monthly values for the PDO index: 1900-September 2009

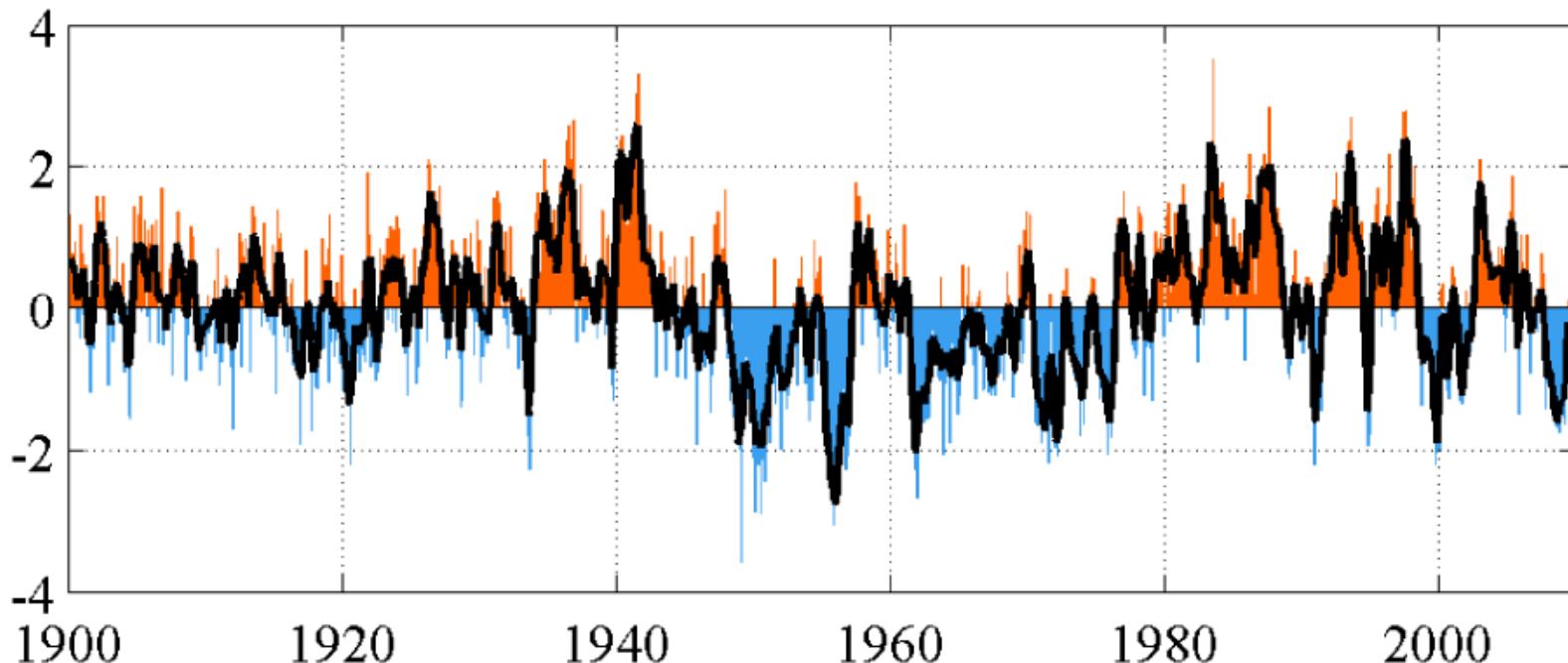
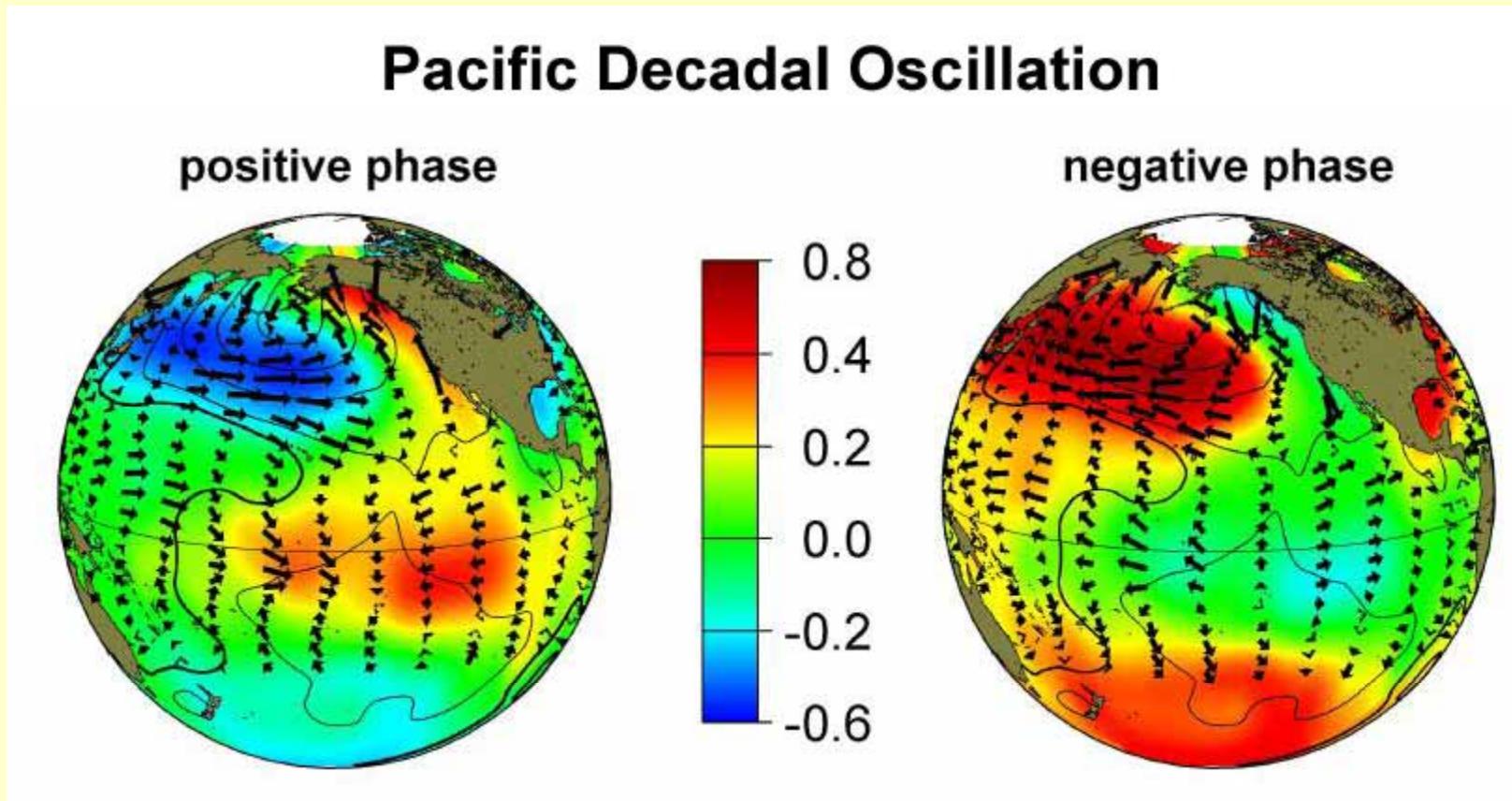


Figure source: University of Washington Climate Impacts Group, Nate Mantua
(<http://jisao.washington.edu/pdo/graphics.html>)

**The PDO has again moved into negative values
(cool phase) in late 2010**

Interactions Between La Niña and the PDO



The PDO this year is negative, or cooler than normal, just like La Niña's effect. This has created a very strong jet stream driving big storms out of Alaska – Bill Patzert JPL

Just Released

GEOPHYSICAL RESEARCH LETTERS.

Biological communities in San Francisco Bay track large-scale climate forcing over the North Pacific

James E. Cloern,¹ Kathryn A. Hieb,² Teresa Jacobson,³ Bruno Sansó,³
Emanuele Di Lorenzo,⁴ Mark T. Stacey,⁵ John L. Largier,⁶ Wendy Meiring,⁷
William T. Peterson,⁸ Thomas M. Powell,⁹ Monika Winder,^{10,11} and Alan D. Jassby¹²

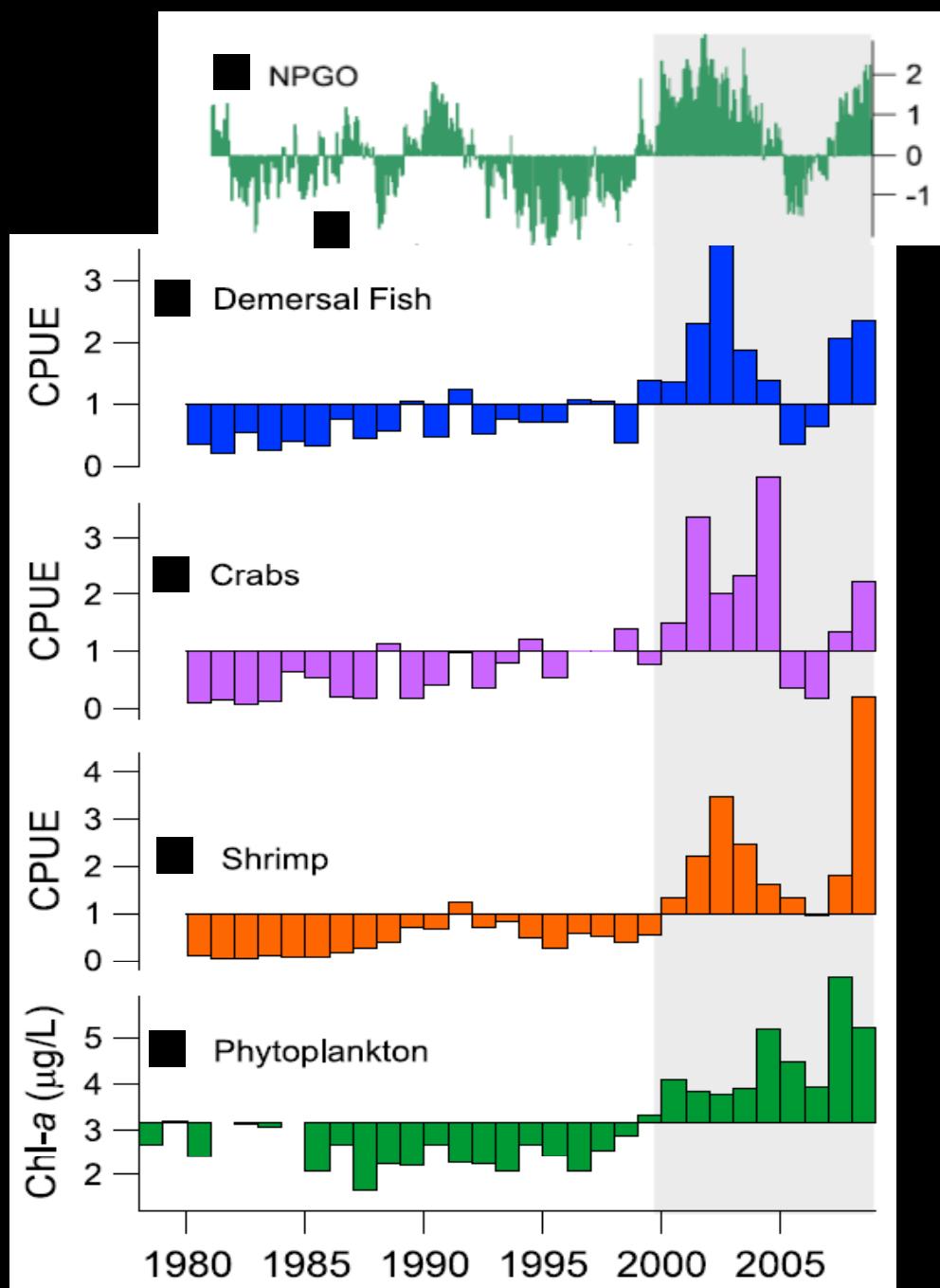
AUTHORS:

USGS
California Department of Fish & Game
NOAA
UC Santa Cruz, Santa Barbara, Berkeley, Davis
Georgia Institute of Technology

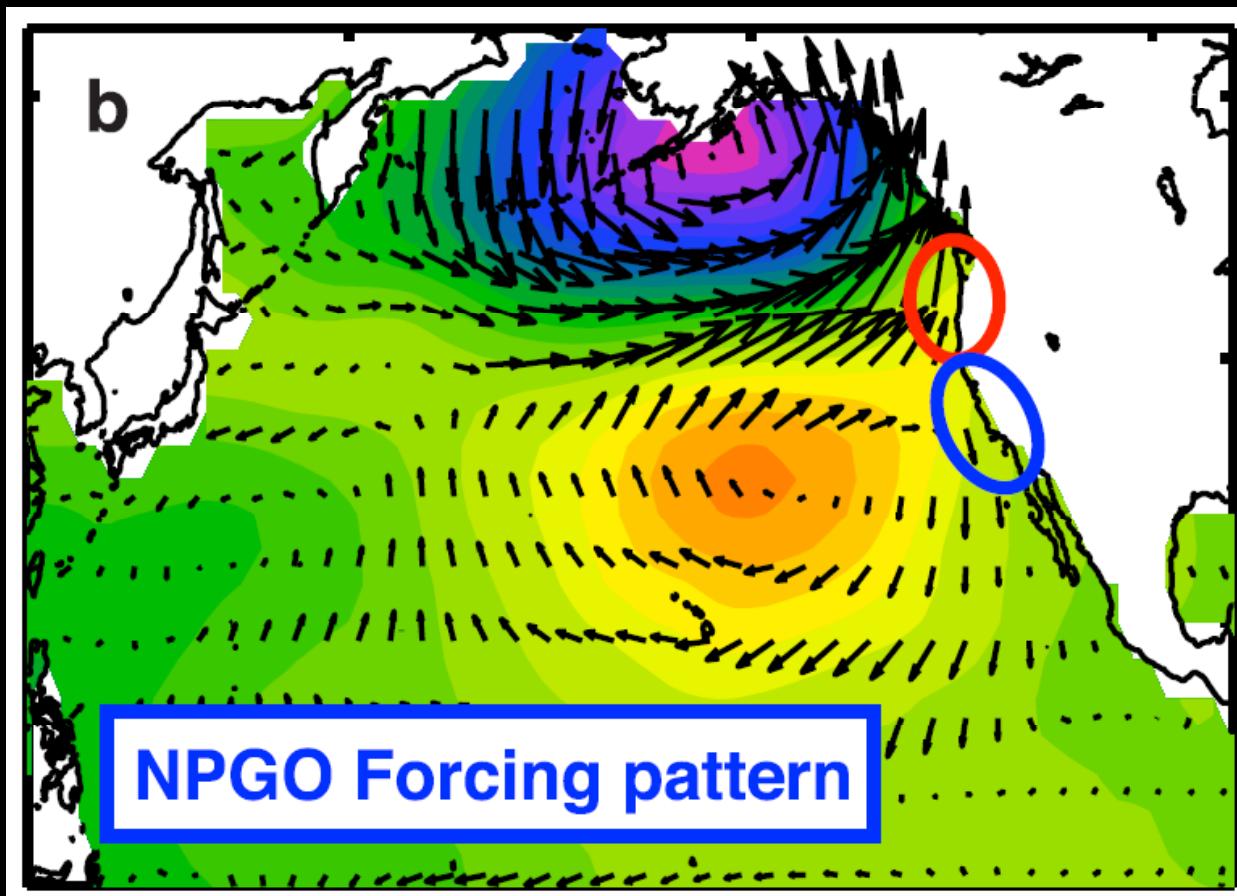
FUNDING:

USGS – National Research Program of the Water Discipline
Toxic Substances Hydrology Program
Priority Ecosystem Science
Interagency Ecological Program (IEP)
National Center for Ecological Analysis and Synthesis (NCEAS)

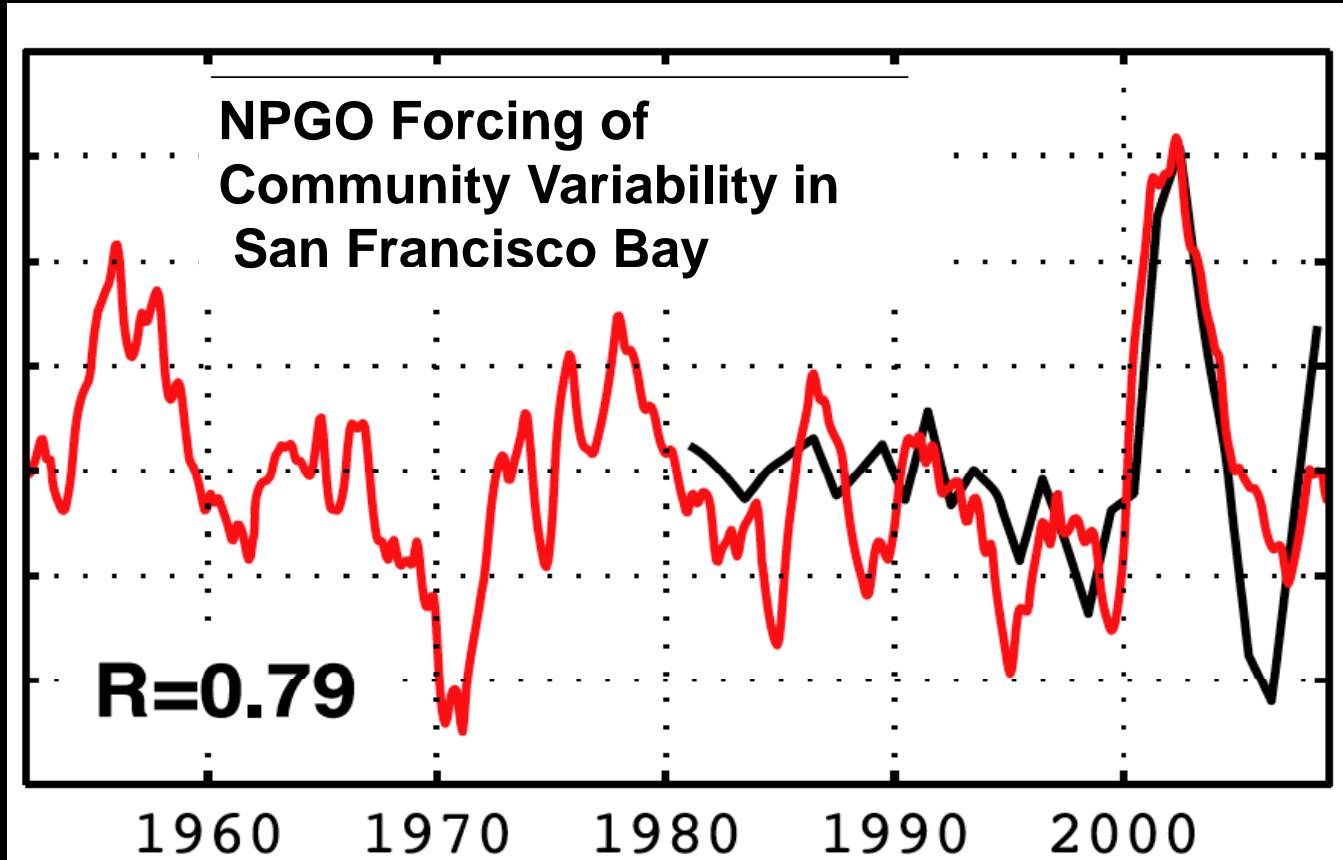
Sharp rises in certain bottom dwelling fish, crabs, and shrimp coincided with a climate shift across the Pacific Ocean, the NPGO.
NPGO = North Pacific Gyre Oscillation



NPGO == high pressure over Hawaii: affects winds, currents and biological productivity in California Pacific coastal waters



Cloern et al. (2010) model community variability in SF Bay from atmospheric pressure over Hawaii (driver of NPGO)



The coastal ocean is strongly influenced by climate patterns, including 20-30 year cycles

So, shifting climate patterns can have a big influence on biological communities and water quality

Ecological collapse in the Delta, but record-high abundances of marine fish, crabs, and shrimp in San Francisco Bay

The key to these discoveries?
sustained, long term observation and research

Climate Indices Summary

Strong La Niña conditions currently are present in the tropical Pacific

The ENSO phenomenon interacts with the PDO to influence precipitation on the west coast of the US – currently driving big storms into northern CA and the Pacific Northwest

The NPGO accounts for about two-thirds of the interannual variability in species abundance of crabs, shrimp, and bottom dwelling fish in San Francisco Bay